Nanotechnology Across The Undergraduate Chemistry Curriculum

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In new exploratory laboratories at Valdosta State University in Georgia, students synthesize and trap the single molecule magnet, Mn12, inside a variety of matrices, such as single walled nanotubes (SWNT) and exfoliated graphite (shown in picture) in order to observe shifts in fundamental magnetochemistry properties in nanometer sized particles. Faculty and staff at the National High Field Magnet Lab work with the students to provide SQUID and TEM measurements. Two papers from this work are in press and one of the students has entered graduated school with a research director situated at the NHFML. A computer science student and a member of the mathematics faculty are working with the NUE-funded group on developing a model for a quantum computer using the unpaired electrons in Mn12 as information storage units. The Valdosta State group also developed an instrumental analysis experiment that features energy transfer between SWNT and alkali-halide salts. A paper outlining this as a three-hour lab and another paper in press in a material science journal describes an effect dubbed "Nanotube Enhanced Raman Spectroscopy (NERS)." In a new set of lab experiments under development for General Chemistry students, C_{60} is oxidized to triprotic bucky-acid and the pK_a's are determined. This lab combines many basic concepts including kinetics, percent yields, electrochemistry, inorganic and acid/base chemistry. Another lab experience under development involves students in investigating the properties of nine allotropes of carbon thereby integrating experiments on classical forms of carbon with industrial materials and new nanostructures. In the cutting edge world of nanotechnology, these NUE-funded educational experiences have led to new science with undergraduates and *vice versa*.